

# Squares, square roots, cubes and cube roots

We are learning that squaring a number gives the area of a square that has sides of that length.



Squared paper, a calculator.

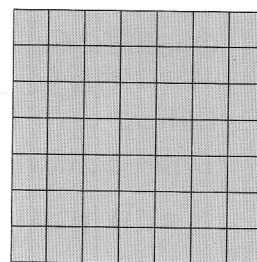
We write  $3 \times 3$  as  $3^2$  and say it as 'three squared' or 'three to the power of two'.

**Example** How many small square tiles are needed to make a square, seven tiles by seven tiles?

$$\begin{aligned}\text{Number of tiles} &= 7 \times 7 \\ &= 7^2 \\ &= 49\end{aligned}$$



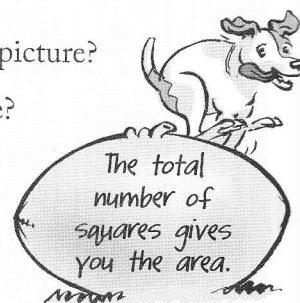
This is called a power or an exponent.



## Activity 1



- 1 Dale makes large square pictures by fitting together small squares of stained glass window.
  - a Today he is making a six square by six square picture. How can he work out how many small squares of glass he will need? Explain.
  - b What if he wants to make an eight square by eight square picture?
  - c What about a square with 10 small squares along each side?
  - d What about a square with  $a$  small squares along each side?
  - e Write each of your answers to a, b, c and d as a number with a power.
- 2 Explain to a classmate and then write down the rule for finding the area of a square of side  $n$  cm.



The total number of squares gives you the area.

3 Sam is making a square collage which is 156 squares by 156 squares. He uses his calculator to find the answer to  $156 \times 156$  and gets 24 336.

Explore using the  $x^2$  button on your calculator to get this answer.



4 Use the  $x^2$  button on your calculator to find the answers to these.

a  $127 \times 127$

b  $309 \times 309$

c  $43^2$

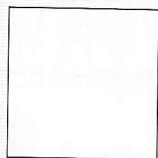
d  $165^2$

e  $2.1^2$

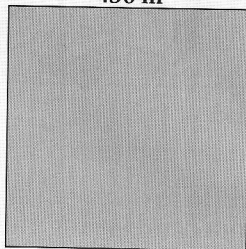
f  $0.5^2$

5 Find the areas of these squares.

a 89 cm



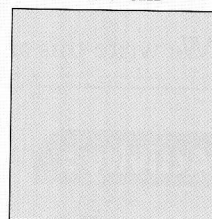
b 436 m



c 5.2 mm



d 43.5 cm



6 Raj is laying ready lawn in a square. The sides of the square are 54 m.

a The ready lawn comes in  $1 \text{ m}^2$  squares.

How many lawn squares does he need?

b Raj needs to fertilise the lawn once it is laid.

He has to apply 8 g of fertiliser per square metre of lawn.

How many grams of fertiliser does he need altogether?

c Next spring he has to apply 11 g of fertiliser per square metre.

How many grams of fertiliser will he need for this?

d The ready lawn company wants to write a rule for how much fertiliser to apply to a square of side  $r$  metres if it must be applied at the rate of  $x$  grams per square metre.

Write the rule in words and then using symbols.

## 7 Challenge

The square number 4 has three factors, 1, 2 and 4.

Which other square numbers, less than 100, have exactly three factors?

How are these square numbers different from the other square numbers?



We are learning that if we know the area of a square we can find the length of the side by finding the square root.



Square cardboard pieces, a calculator.

**Finding the square root is the opposite of squaring a number.**

**Example** A square has been made using 49 tiles.  
How many rows of tiles are there and how many tiles are there in each row?

**There are 7 rows of 7 tiles.**

We write this as  $\sqrt{49} = 7$



$\sqrt{\quad}$  means 'the square root'.  
The square root of 49 is 7 because  $7 \times 7 = 49$ .

## Activity 2



1 Mr Paver made some large square courtyards using the following numbers of paving stones.

a 25   b 36   c 64   d 121   e 144

Show, using cardboard squares, the number of paving stones that are along each side of each courtyard.

- 2 a If you know the area of a square, explain to a classmate how you can find the length of the side. Write down your explanation.  
b If the area of a square is  $b$  units<sup>2</sup>, finish this rule for finding the length of one side.

**Length of a side =**

3 Millee wanted to know the length of the side of a square that had an area of 1444 m<sup>2</sup>. She wrote the calculation she needed to do as  $\sqrt{1444}$ .

She used the  $\sqrt{\quad}$  button on her calculator to get the answer 38.

What did Millee have to key and in what order to get this answer?

- 4 The answer to  $\sqrt{94}$  will be somewhere between 9 and 10 because  $\sqrt{94}$  is between  $\sqrt{81}$  and  $\sqrt{100}$ . It will be closer to 10 than to 9.



Estimate the answers to these using your basic facts knowledge.

Discuss your estimations with a partner and explain your reasoning.

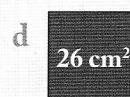
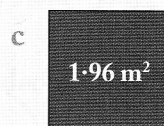
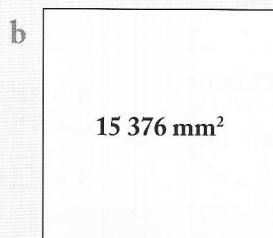
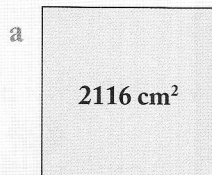
Use the  $\sqrt{\quad}$  button on your calculator to find the answers.

a  $\sqrt{484}$    b  $\sqrt{18\,225}$    c  $\sqrt{1.44}$    d  $\sqrt{12.96}$    e  $\sqrt{0.09}$   
f  $\sqrt{35}$    g  $\sqrt{89}$    h  $\sqrt{284}$    i  $\sqrt{4.5}$    j  $\sqrt{16.25}$

Round the answers to f to j to the nearest tenth.



- 5 Find the length of the side of each of these squares.



Round d sensibly and remember the units in your answers.



- 6 Marcia was told she needed a square cover of area 19 m<sup>2</sup> to cover her new hot pool. She wanted to work out the length of each side of the square cover.

Marcia had a  $x^2$  button on her calculator but not a  $\sqrt{\phantom{x}}$  button.

- a She began like this.  $\sqrt{19}$  must be between  $\sqrt{16}$  and  $\sqrt{25}$   
so  $\sqrt{19}$  is between 4 and 5.

Is Marcia correct? Explain her reasoning and why she chose these numbers.

- b Marcia worked out the squares of the numbers in this table.

Copy the table. Use the  $x^2$  button on the calculator to fill it in.

$4 \cdot 1^2$	$4 \cdot 2^2$	$4 \cdot 3^2$	$4 \cdot 4^2$	$4 \cdot 5^2$	$4 \cdot 6^2$	$4 \cdot 7^2$	$4 \cdot 8^2$	$4 \cdot 9^2$

- c Between which two numbers on the table does  $\sqrt{19}$  lie? Explain.

- d Marcia wants to know what  $\sqrt{19}$  is to two decimal places.

This shows part of the table she drew.

Explain why she did this.

$4 \cdot 31^2$	$4 \cdot 32^2$	$4 \cdot 33^2$

- e Copy and complete Marcia's table.

Between which two numbers on your table does  $\sqrt{19}$  lie?

- f What is  $\sqrt{19}$  to two decimal places? Explain your answer.

- 7 Only using the  $x^2$  button on your calculator decide if these are true or false.

- a  $8 \cdot 01 < \sqrt{64 \cdot 3} < 8 \cdot 02$     b  $6 \cdot 52 < \sqrt{42 \cdot 6} < 6 \cdot 53$     c  $16 \cdot 14 > \sqrt{262 \cdot 02} > 16 \cdot 16$   
d  $4 \cdot 384 < \sqrt{19 \cdot 22} < 4 \cdot 385$     e  $36 \cdot 154 > \sqrt{1308 \cdot 54}$     f  $0 \cdot 256 > \sqrt{0 \cdot 0652} > 0 \cdot 255$

## 8 Challenge



Find  $\sqrt{32}$  to two decimal places using only the  $x^2$  button on your calculator.  
Explain to a classmate how you did this.